ROYAL ASTRONOMICAL SOCIETY.

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MANUEL J. JOHNSON, Esq., President, in the Chair.

Joseph Baxendell, Esq., Manchester;
J. Masters Share, Esq. R.N., Tynemouth;
Capt. John Vine Hall, Southampton;
Wm. Bolger Gibbs, Esq., Camberwell;
Lieut. Jos. Dayman, R.N.;
Geo. Andrew Rogers, Esq., 2 Park Villas, Highbury Grove;
Capt. A. S. H. Lowe, Highfield House, Nottingham;

were balloted for and duly elected Fellows of the Society.

Results of the Observations of Small Planets made at the Royal Observatory, Greenwich, in the Month of December, 1856.

(*Communicated by the Astronomer Royal.*)

Melpomene.

Mean Solar Time of Observation.	Apparent R.A.	Apparent N.P.D.
	h m s	h m s
1856, Dec. 13	8 43 47·8	2 14 39·01
		° ′ ″
		94 36 38·46

Eunomia.

Mean Solar Time of Observation.	Apparent R.A.	Apparent N.P.D.
	h m s	h m s
1856, Dec. 10	7 18 33·6	0 37 21·11
		° ′ ″
		.....

Massilia.

Mean Solar Time of Observation.	Apparent R.A.	Apparent N.P.D.
h m s	h m s	° ′ ″
1856, Dec. 13 8 40 6·3	2 10 56·96	77 20 3·68

Amphitrite.

Mean Solar Time of Observation.	Apparent R.A.	Apparent N.P.D.
h m s	h m s	° ′ ″
1856, Dec. 26 9 7 29·9	3 29 40·33	61 29 6·43

Occultation of Jupiter by the Moon, on Oct. 12, 1856, *as observed at Madras.* By Captain Jacob.

Instrument—the 6·25-inch equat. power 174, throughout.

			Madras Sidereal Time. h m s	
Dark limb,	4th Sat.	first contact	23 34 16·7	
		disappearance	23 34 19·7	(*a*)
	Jupiter,	first contact	0 1 42·1	(*b*)
		disappearance	0 5 0·7	
	1st Sat.	disappearance	0 6 54·0	(*c*)
	2d Sat.	disappearance	0 15 22·4	(*c*)
	3d Sat.	first contact	0 24 41·1	(*d*)
		disappearance	0 24 50·6	
Bright limb,	Jupiter,	reappearance	0 46 11·4	(*e*)
		last contact	0 49 16·6	
	1st Sat.	last contact	0 49 17·6	(*f*)
	2d Sat.	last contact	0 50 24·7	
	3d Sat.	last contact	0 52 4·8	

(*a*) The satellite vanished and reappeared for an instant. Its light shone very dimly (like a kind of twilight) just at the last.

(*b*) The moon's limb, as seen upon *Jupiter*, showed several projecting points. *Jupiter* finally disappeared in a hollow; so that the last portion visible was triangular.

(*c*) First contact could not be caught.

(*d*) Uncertain to 1^s or 2^s.

(*e*) Late 1^s or 2^s; *Jupiter* being very dim at first appearance. No distortion visible either at immersion or emersion; but the last portion of all the satellites (at immersion) seemed to hang for an instant on the limb, and was very dim. The same was noticed of *Jupiter*, though in a less degree.

(*f*) First appearance could not be caught.

Occultation of the Pleiades by the Moon, on Nov. 12, 1856, *as observed at Madras.* By Capt. Jacob.

			Madras Sidereal Time. h m s	
η	Tauri	disappearance	7 17 48·2	(*a*)
23	—	reappearance	26 50·2	
1176	B. A. C.	disappearance	34 24·2	
27	Tauri	disappearance	48 24·2	(*a*)
η	—	reappearance	48 44·2	(*b*)
28	—	disappearance	58 42·2	
1188	B. A. C.	disappearance	8 4 28·2	(*c*)
1186	—	disappearance	6 46·2	(*c*)

Interrupted by clouds and rain. Moon very near the full. Power employed, 114.

(*a*) The star seemed to slide on to the moon, but was not distinctly visible on its face. Sky hazy, with flying clouds.
(*b*) Doubtful to about 1^s, being hurried from the previous observation.
(*c*) Uncertain to 2^s or 3^s, the stars being dim through the haze.

Occultations of Stars by the Moon, observed at Highbury. By T. W. Burr, Esq.

The following occultations in the year 1856 have not been previously reported:—

		Mag.		Local Sid. Time. h m s	
Jan. 12	27 Piscium	5	Immersion	1 16 39·9	Dark limb.
			Emersion	1 33 4·4	Bright limb.
March 13	136 Tauri	4½	Immersion	8 19 23·9	Dark limb.
			Emersion	9 31 7	Bright limb.
July 25	τ^2 Arietis	6	Immersion	20 48 23·9	Bright limb.
			Emersion	20 59 57·9	Dark limb.
	65 Arietis	6	Immersion	21 10 56·9	Bright limb.

The immersions of τ^2 and 65 *Arietis* are rather uncertain. The first ran along the edge of the lunar crescent for some seconds, rendering the moment of disappearance doubtful, and the latter was affected by the boiling and bad definition of the moon's limb. The other observations are good.

Notice of his Solar-spot Observations. By R. C. Carrington, Esq.

It is pretty generally known that during the past two years the surface of the sun has exhibited a comparative state of quiescence, the outbreaks of spots being few and often far between, and the spots themselves for the most part small. The Redhill observations, however, indicate that the epoch of least action is now passed, and as they appear to fix the date of the minimum with

some degree of certainty, it is thought that the following numbers may not be without interest. In the first column is given the number of days on which spots were seen on the disk in each month; in the second, that on which no spots were found; and in the third, the percentage of spot-days to days of observation, as a measure of frequency. The fourth column contains the means of successive numbers in the third, and the fifth the means of those in the fourth.

	Spots.	No Spots.	$\frac{(1)}{(1)+(2)}$		
1855, Jan.	8 days	5 days	·62	74	
Feb.	11	2	·85	81	77
Mar.	13	4	·77	55	68
Apr.	7	15	·32	35	45
May	5	8	·38	32	34
June	6	17	·26	15	24
July	1	23	·04	14	14
Aug.	7	23	·23	15	14
Sept.	1	16	·06	33	24
Oct.	11	7	·61	41	37
Nov.	3	11	·21	18	29
Dec.	3	19	·14	7	12
1856, Jan.	0	13	·00	11	9
Feb.	2	7	·22	11	11
Mar.	0	16	·00	20	15
Apr.	7	11	·39	22	21
May	1	20	·05	20	21
June	7	13	·35	40	30
July	10	12	·45	44	42
Aug.	10	14	·42	47	45
Sept.	12	11	·52	43	45
Oct.	3	6	·33	46	44
Nov.	13	9	·59	52	49
Dec.	7	9	·44		

An inspection of the numbers in the fifth column will show that the date of the minimum of energy, as exhibited by the spots, may now be assigned with tolerable certainty to the beginning of the month of February 1856, the ratios increasing slowly and perceptibly from that time. The substitution of the numbers in the fifth column for those in the third is simply equivalent to the graphical process of drawing a curve among, but not through, the summits of the ordinates representing the original numbers, a process which may be repeated if the curve still contains too violent inflexions, or may be modified by the introduction

of weights. The constitutional peculiarities still remain, but in a milder form.

The system of observation and reduction described in a previous number of the *Monthly Notices* has been continued as before; but it is not intended here to offer any remarks on the results, as through the more pressing nature of other work, Mr. Carrington has not yet been able to give any adequate time to the discussion of the positions observed. The year 1856 has been characterised by the rather frequent occurrence of low south spots, the latitudes 27° south and 35° south having each been more than once visited. As a general remark, it may be stated that when an outbreak occurs on a parallel not previously affected for several months, it is mostly found that two or three other outbreaks succeed at moderate intervals of time, not, however, at the corresponding longitudes, when the rotation of the surface is allowed for; and herein, it is believed by Mr. Carrington, that there lies a something for investigation. This and some other points noticed will, however, be inquired into with better opportunities when more raw material has been accumulated, and when we have arrived at a period of more activity than the present.

Extract of a Letter from Professor Hansen, on an Ancient Eclipse.

(*Communicated by the Astronomer Royal.*)

"I have calculated an ancient eclipse, namely, that of Ennius, of which Cicero gives an account in his work, *De Republicâ*, discovered within the last few years; whence it may be reckoned as one of the most certain and well-established eclipses of antiquity. Ennius says, according to Cicero, 'Nonis Junii soli luna obstitit et nox.' Now, in Cicero's time, the Nones of June fell on the 5th; but, in the time of Ennius, on account of the lunar years and the intercalary month of the Romans, they fell between June 5 and July 4. On this account the following data, which have been investigated for this eclipse, may be considered acceptable:—

399, June 21.					
Greenwich Mean Time.	Moon's Longitude.	Moon's Latitude.	Equatoreal Hor. Parx.	R. A.	Decl.
h m	° ′ ″	° ′ ″	′ ″	° ′ ″	° ′ ″
3 36	82 39 47·4	+0 31 41·1	60 24·65	81 57 37·3	+24 4 13·3
4 48	83 24 0·0	35 45·1		82 45 45·2	10 39·0
6 0	84 8 10·7	39 48·5	22·10	83 33 55·5	16 49·4
7 12	84 52 19·6	43 51·4		84 22 8·5	22 44·3
8 24	85 36 26·6	+0 47 53·7	60 19·35	85 10 23·8	+24 28 23·4

G.M.T.	Sun's Longitude.		Log. Rad. Vector.	Sun's R.A.	Sun's Decl.
h m	° ′ ″			° ′ ″	° ′ ″
3 36	83 40 1·7			83 5 12·0	+23 35 44·2
6 0	83 45 45·4		0·00708	11 26·5	36 0·9
8 24	83 51 29·1			83 17 41·3	+23 36 17·0
Obliquity = 23° 44′ 57″·8					

"These places give the following points of the curve of the central eclipse:—

Longitude, East of Greenwich.	Latitude.
° ′	° ′
8 41	44 4
9 39	43 36
10 38	43 8
11 38	42 40
12 37	42 12

"The central eclipse passes, therefore, very nearly over Rome. I have now obtained for Rome:—

	Mean Time at Rome.
	h m
Beginning of the eclipse generally	6 40
Beginning of the total obscuration	7 30
End of the total obscuration	7 33
End of the eclipse generally	8 20

"On this day the sun set at Rome at $7^h\ 36^m$ Roman Mean Time; the total eclipse was, therefore, quite visible at Rome, and the sun set immediately after the completion of it. By this means does the otherwise unintelligible passage of Ennius, 'Soli luna obstitit et nox,' become quite clear; the poet has simply omitted the word 'simul.'

"Professor Zech has previously found an eclipse at the setting of the sun at Rome; but he obtains only a partial eclipse, and its maximum takes place after the sun has set. His longitude of the moon is 8′ 51″ too small, and his latitude is too great by 1′ 46″."

Abstract of a Report on the Determination of the Latitude at Karachi. By Lieut. Tennant, of the Bengal Engineers, First Assistant G. T. Survey of India.

The operation took place in March and April 1855. The paragraphs in inverted commas are from the author's MSS.

"It having been considered desirable that the latitude should be well observed in the neighbourhood of Kărāchi, both as an initial element for the Great Indus Series, which will form

the western limit of the G. Trig. Survey operations, and as verificatory of the results of the Great Longitudinal Series, I was instructed by the Surveyor-General during the recess of 1854 to build an observatory in the neighbourhood of the Karachi Base, where this datum might be astronomically determined.

"I finally fixed on Bath Island as the site of the Observatory. The so-called island is an isolated hill situated about half-way between Karachi cantonment church and the Sanatarium of Clifton. It is nearly surrounded by the sea at each high-water, and at the highest spring-tides is completely so. The road from Karachi to Clifton passes to the east at some distance, and there were no buildings of any description on the island.

"In order to secure so valuable a locality, I procured from the commissioner in Sind a grant of the whole island beyond cantonment limits; and it will be a good site for a permanent observatory, should one be established in this part of India. The surface of the island is a loosely conglomerated gravel; but at about 3·5 feet below it, a layer of firmer materials is found, on which the walls, and collimator-, and clock-pillars, are supported; and about 4·5 feet again below this another very firmly consolidated stratum formed the support for the pillars of the instruments." . . .

Drawings, in full detail, accompany the paper, showing the construction of the walls and roof, and provision for ventilation.

"The mark to which each instrument was adjusted is a fine drill-hole in a brass plug, which was fixed in the pillar on the level of the floor.

"The position of the geodesical station is as follows, from the connexion with the Great Longitudinal Series:—

Latitude (from Kalianpur)	24	49	50·2 N.
Longitude (corrected to Taylor's last result for Madras)	67	1	0·7 E.
Height above sea-level of mark	38·10 feet.		

"The last element was determined in the harbour, and the level brought up trigonometrically."

The instruments used were the "Troughton" astronomical circle, described in Col. Everest's account, the Troughton and Simms' 34-inch theodolite, modified in some of its parts, a clock by Jones, and a collimating apparatus extemporised for the occasion.

In selecting the stars for observation, the Surveyor-General had decided that they should be about thirty in number, and should extend over 30° of N.P.D., situated half on each side of the zenith; and that the zenith distances to the north were to be equal to those to the south, as nearly as possible, to eliminate any error in the refractions applied.

The mode of observation was very generally similar to that described in Col. Everest's work. The number of stars ultimately selected was thirty-three, recently determined positions of the

whole of which were received from Madras, and of eighteen of which from Greenwich. Lieut. Tennant finds a small outstanding discordance in his two results, when the two authorities for the stars are separately used, which for the present he leaves undecided, giving the preference temporarily to the results from the Madras stars, for reasons stated in the MSS.

The latitude of the Karachi geodesical station thus found (from 807 observations) was—

	°	′	″
By Madras positions of stars	24	49	49·3
Greenwich			50·0

The azimuth of the referring mark was found to be,

	°	′	″
By E. and W. elongations of *Polaris*	179	59	57·4
Same as brought up from Kalianpur			57·7

The intermediate results of the calculations are given in tables at much length.

An Examination of the Figure of the Indian Meridian as deduced by the Venerable Archdeacon Pratt from the two Northern Indian Arcs; with a Proposition for testing that form by Astronomical Observation. By Lieut. J. F. Tennant, Bengal Engineers, F.R.A.S.

1. On my arrival in May last at the Surveyor-General's Office, I met with Mr. Pratt's paper on Himalayan Attraction in the *Philosophical Transactions*, and it occurred to me that the arc of longitude from Kalianpur to Karachi completed in 1853 would furnish a means of verifying its results.

2. When, however, I applied the data given by Mr. Pratt to it and the southern meridianal arc, I became convinced that some error had been committed in the solution of the equations, and I therefore examined this with the following result.

The mean value of $d\,e$ was

$$-\,0{\cdot}00097840\,;$$

whence we get

$$e = 0{\cdot}00234605,$$

which coincides to the last figure with the value given in the paper referred to.

On adding, however, the three equations, and substituting this value of e, I found

$$\alpha = -\,0{\cdot}0019209$$

which differs entirely from the value given for this quantity.

3. Using these values of $d\,e$ and α, I find the following

elements for this ellipse, and these being the true results of his paper, I shall use as Mr. Pratt's value, distinguishing them and all deductions from his hypothesis by subscribing the letter P to the algebraical representative of the quantity, and calling this hypothesis P.

$$a_P = 20882740{\cdot}94 \text{ feet.}$$

$$b_P = 20833863{\cdot}65$$

$$e_P = 0{\cdot}00234605$$

4. Similarly I shall call the dimensions given by Colonel Everest in his work of 1830 (and which are still in use), hypothesis E, and subscribe that letter in the same way to its results.

$$* \; a_E = 20922931{\cdot}80 \text{ feet,}$$

$$b_E = 20853374{\cdot}58$$

$$e_E = 0{\cdot}003324449$$

5. I first compared these values with Col. Lambton's arc Damergida to Punæ by means of the formula given in Mr. Airy's treatise "On the Figure of the Earth," and also that in Mr. Pratt's paper.

By the former the length

$$l = b\left\{1 + \frac{e}{2} - \frac{3}{2}e \,.\, \cos(\lambda' + \lambda'') \,.\, \frac{\sin(\lambda' - \lambda'')}{\lambda' - \lambda''}\right\}(\lambda' - \lambda'') \sin 1''$$

and by the latter

$$l = a\left\{1 - \frac{e}{2} - \frac{3}{2}e \,.\, \cos(\lambda' + \lambda'') \,\frac{\sin(\lambda' - \lambda'')}{\lambda' - \lambda''}\right\}(\lambda' - \lambda'') \sin 1''$$

Now the observed Latitude of Damergida is $18^\circ\ 3'\ 16''{\cdot}075$ for Hyp. E.
And the attraction on hypothesis P ..... + $6''{\cdot}909$

$\therefore$ The latitude for hypothesis P is ..... $18^\circ\ 3'\ 22''{\cdot}984$

Also the observed latitude at Punæ is $8^\circ\ 9'\ 32''{\cdot}509$, which I shall assume without change for both figures. We have then for hypothesis P,

$\lambda'_P + \lambda''_P = 26^\circ\ 12'\ 55''{\cdot}493$ $\qquad$ $\lambda'_P - \lambda''_P = 9^\circ\ 53'\ 50''{\cdot}475$

Whence the length is on hypothesis P, by Mr. Airy's formula 3591803 feet.
,, ,, ,, Mr. Pratt's 3591787 ,,

And, again, for hypothesis E:

$\lambda'_E + \lambda''_E = 26^\circ\ 12'\ 48''{\cdot}584$ $\qquad$ $\lambda'_E - \lambda''_E = 9^\circ\ 53'\ 43''{\cdot}566$

Whence the length is on hypothesis E, by Mr. Airy's formula 3591533 feet.
,, ,, ,, Mr. Pratt's 3591501 ,,

* These lie between the values given by Messrs. Airy and Bessel.

6. The true length of this arc being 3591779 feet, it would seem that P gives a closer approximation to it. E, however, is nearest to the unaltered observed data; and, the attracting mass lying to the north, it is not in a southerly direction that hypothesis P would fail, if the attractions are erroneous, till both ends of the arc are beyond the limits of sensible attraction. I have only placed these results here to show that the consideration of this arc has not been neglected, as I do not think it can have any weight against that which follows.

7. In the year 1853 a great arc of longitude was completed, extending from Kalianpur to Karachi in Sind, with the following position of its ends:—

	Latitudes.		Longitudes.	
Kalianpur	24° 7′ 11″·262	observed.	77° 41′ 44″·75	Geodetically computed from Madras as an origin.
Karachi..	24 49 50·155	Geod. comput.	67 4 2·47	

The computations, according to the custom of the department, being made on the figure E, commencing with the place of Kalianpur.

On hypothesis E, therefore, the mean latitude of this arc is—

$$\lambda_E = 24^\circ\ 28'\ 31''$$

and its amplitude

$$\Delta L_E = 10^\circ\ 37'\ 42''{\cdot}28$$

8. On hypothesis P, however, the latitude of Kalianpur should be increased by 11″·9, that being the supposed attraction; and as the difference of the latitudes of the extremities will not be materially affected, we shall have

$$\lambda_P = 24^\circ\ 28'\ 43''.$$

9. The value of the length of an arc of longitude is given by Mr. Airy as $= b\{1 + e + e \sin^2\lambda\}\,\Delta L \sin 1''$, and if we assume the length given in both arcs we shall have

$$\Delta L_P = \Delta L_E \cdot \frac{b_E(1 + e_E + e_E \sin^2\lambda_E)}{b_P(1 + e_P + e_P \sin^2\lambda_P)}$$

whence I obtain

$$\Delta L_P = 10^\circ\ 39'\ 2''{\cdot}19 = \Delta L_E + 0^\circ\ 1'\ 19''{\cdot}81.$$

9. In order, however, to compare the longitude of Karachi with an observed value, we must consider that the amplitude from Madras to the meridian of Kalianpur was derived from a figure nearly approximating to E, though the method was not rigorous. The correction on this account may be assumed as + 22″·5, to suit the hypothesis P.

10. At Karachi I observed on the 22d of May, 1853, an occultation of β_1 *Scorpii*, which I have computed with Mr. Adams'

value of the lunar parallax and semidiameter. The star's place I took from the Greenwich Results for 1852, and the errors of the Moon's place were interpolated for the mean time from a memorandum kindly furnished by Mr. Airy. Hence I deduced the longitude of my station.

	h	m	s	
By the Immersion..	4	28	3·304	East.
Emersion ..	4	28	5·716	
Mean	4	28	4·510	= 67° 1′ 7″·65 East.

And of the same point reducing to Mr. Taylor's last result for Madras, the longitudes are,

	°	′	″
By hypothesis E ..	67	1	37·64
And by hypothesis P ..	66	59	55·33

E having very decidedly the advantage.

11. The most certain test, however, I have it in my power to apply, is the agreement of the azimuth at Karachi as observed, and that geodetically brought up by computation from Kalianpur.

If the azimuthal angle of B as seen from A be A, and the reverse angle of A seen at B be B, each measured from the north, and we take $B = \pi - (A + \Delta A)$: then, in accordance with Dalby's theorem,

$$\tan \tfrac{1}{2} \Delta A = \frac{\sin \frac{1}{2} (\lambda' + \lambda'')}{\cos \frac{1}{2} (\lambda' - \lambda'')} \tan \tfrac{1}{2} \Delta L$$

Computing, then, the two values of Δ A from the data already given, we shall have between Kalianpur and Karachi

	°	′	″
ΔA_E =	4	24	50·14
ΔA_P =	4	25	25·16
Difference			35″·02

which, the computations having been made on hypothesis E, should be the discordance of the azimuths at Karachi, the computed value exceeding the observed one, as the azimuths are measured from south by west; but in a paper on the latitude of Karachi, which I have lately transmitted to the Astronomical Society, I have given the comparison of the observed azimuth at Karachi with that brought up geodetically from Kalianpur, showing that the former is in defect only o″·312.* No errors of observation, and no possible attraction could account for the enormous amount of

* The azimuth at Kalianpur cannot be greatly in error, as the discordance in latitude at Karachi I have shown in the same paper to be only o″·882, and this is the direction we should expect from the neighbouring elevated masses. It must, besides, be considered that Mr. Pratt's attraction would, if it existed, cause the observed azimuth at Kalianpur to be in defect, and thus the error (including this source) would be increased at Karachi.

35″ in azimuth, and it appears alone sufficient evidence that the hypothesis P is irreconcileable with this arc; unless indeed we were to assume in addition, that the minor axis of the generating ellipse is not the axis of the Earth's revolution, but parallel to it, at such a distance, as to retain the radius of the parallel of latitude.

12. A variation from the general form of the Earth's surface so great as that of hypothesis P is difficult to imagine, for the distance of every point in P from the centre is less than that of the corresponding point in E. The evidence of its existence is so combined with that of deflection of the plumb-line without any real change of form, that it appears impossible to separate entirely these deviations; but the following considerations may, I think, at some future time give a means of deciding on the preferable form.

13. In the first place, the attraction is so enormous, if Mr. Pratt's values hold good, near the mountains, that in longitude it should at Banog Hill Station amount to nearly 20″. If this quantity be called δ L, ν the normal to the minor axis of the spheroid, and λ the latitude of the station; we should expect all the observed right ascensions of the Moon to be affected with a parallax of the form $-\alpha$ P cosec Moon's N.P.D., where $\alpha = \frac{\nu}{a} \cos\lambda \tan \delta$ L (δ L being positive when it tends to increase the east longitude), and after correcting all transits by a term of this form (which, however, would be very small), we should obtain the apparent longitude or inclination of the apparent plane of the meridian to that of Greenwich.

14. The parallaxes, however, of the Moon in right ascension and north polar distance would give means for determining the deflection of the zenith in longitude, as the hour-angle from the hour-circle passing through the production of the Earth's radius would be necessary for their determination. This deflection could consequently be determined from occultations, though of course any determination where the errors bear so large a proportion in all likelihood to the quantity sought, as in this case, must necessarily be uncertain.

15. In the same way a geocentric latitude might be determined from occultations, and compared with an assumed figure, but with greater accuracy. Thus by the Great Arc Series of Triangles the latitude of Banog Hill Station, as brought up geodetically from

Kalianpur is	*30°	28′	36″·96
and that of Kaliana is	*29	30	44·78
whence the amplitude is (hypothesis E) ..	0	57	42·18

and on hypothesis E the geocentric latitude of Banog would be 30° 18′ 37″·48.

* These differ from the values given in Colonel Everest's work published in 1847, being uncorrected for the discrepancy in latitude at Kaliana.

But if hypothesis P be true, the amplitude from Kaliana to

	°	′	″
Banog would be	0	57	45·22
and Mr. Pratt's corrected latitude of Kaliana is ..	29	31	16·75
whence the latitude of Banog should be ..	30	29	1·97
and the geocentric value would be	30	21	58·87

16. The difference between the geocentric latitudes of this point on these hypotheses is then $0^\circ\ 3'\ 21''{\cdot}39$, a large quantity, whose effects would be felt in the parallaxes, for in Admiral Smyth's description of the Bedford Observatory the tenth part of this is spoken of as having a decided effect on the results of occultations.

Possibly by this means we might determine the geocentric latitude within three or four seconds.

17. If an estimate of the attraction at Banog could be made, it would evidently be possible with this and the observed latitude to deduce an angle of the vertex, and an approximate compression of the Earth. The uncertainty of the data, however, and proximity of the attracting masses, would render this result very unsafe, and a preferable proceeding appears to be to determine what constants in the figure of the Earth will deduce the geocentric latitude at the Northern Station from the astronomical latitude of Punæ, which in this investigation we may consider beyond the influence of the mountains.

The compression so obtained would give an astronomical latitude of the Northern Station, which, compared with the observed datum, would show a value of local deflection more trustworthy probably than any resulting from assumed magnitudes, positions and densities of the attracting masses, however carefully these estimates might be made.

I purpose, when my duties in the field allow me, to investigate the necessary formulæ for these determinations.

The instruments at the Lucknow Observatory have, by the annexation of the Kingdom of Oude, become the property of the East India Company. Should it be determined to resume their employment, it may be worth while to remove them to a point on the first Himalayan Range. They might then be employed in determining the longitude close to the axial meridian of India (that of the Great Arc), and in endeavouring to make some estimation of the great local attraction. Situated far above the lower strata of the atmosphere, they would be in a position to examine into the question of "solar refraction" as proposed by Professor C. P. Smyth; and with a telescope of adequate power would be in a more favourable position for micrometrical observations than any other permanently established observatory.

S. G.'s Field Office, Sept. 24, 1856.

Various Observations. By W. Lassell, Esq.

"1856, July 28th, $11^h\ 40^m$ G.M.T. Turned the large equatoreal upon the planet *Juno*, and examined it with various powers, from 160 to 1018; but it did not bear the high powers well, and nothing like a *disk* could be seen. In colour it is certainly ruddy, but not so much so as a star of similar magnitude more south in the field, which is a good deal like it in character.

"July 30. Examined *Juno* again with various powers up to 1018, but could get no other image than what a fixed star of similar magnitude would give. It seems scarcely so red to-night, being just on the meridian ($12^h\ 20^m$): I should call it full yellow, or rather orange. There is an exceedingly minute star, nearly south, distant perhaps 20″. *Juno* estimated $8\frac{1}{2}$ magnitude.

"August 3. Scrutinised the planet for some time with 160, 565, and 1018, without detecting anything planetary about the disk; but it is curious that I again see a star, the faintest thing possible (with 24 inches aperture), in the immediate neighbourhood of the planet. Planet estimated to be barely so bright as the $8\frac{1}{2}$ magnitude.

"August 31. Surveyed *Juno* for some time with single lens 479. On comparing the effect of magnifying power on this planet, and on neighbouring stars of similar magnitude, I cannot find that the light fades more on the planet, nor could I by any scrutiny of the planet's appearance distinguish it from a fixed star. The altitude of the planet, however (not 29°), is too low for this telescope and power. I do not detect any minute star near the planet to-night. Sky brilliant, but confused.

"*Comparison of Relative Efficiency of Prism and Plane Speculum*, which are considered to be of equal perfection of workmanship.

"July 30. About $11^h\ 20^m$ observed (not, however, for the first time) a minute star (a) north of the most following of the 'debilissimæ,' and about one-fifth of the way towards the northern double.

"I had then the plane speculum in the tube in bright condition; and as the sky was steadily bright and clear, I took out the plane speculum, and put in the prism, also in very good order. Powers 430 and 1018 were used in both instances; and I came to the conclusion that, though this minute point might be called the 'minimum visibile' with either plane, yet it was somewhat more constantly seen with the prism than with the speculum; especially with the lower power, which scarcely sufficed to show it steadily with the speculum. The superiority of vision, however, even with 1018, was not *striking*, though certain, and a very slight deposition of dew on the prism would suffice to neu-

tralise the advantage. The speculum never sensibly collects dew. Therefore, it is only on objects of the last degree of faintness, such as the satellites of *Uranus* and *Neptune*, in this telescope, that the general superiority of the prism is apparent.

"November 28. In observing the satellites of *Uranus*, I could not make myself absolutely sure that I saw *Umbriel*, which is generally the faintest of them all, the plane speculum being in the tube. On putting in the prism, the suspected position of *Umbriel* was at once verified. The single drawback to the general use of the prism is its extreme liability to contract dew; and I have in succession resorted to various contrivances to obviate this annoyance. Both the plane specula and the prisms are mounted in boxes, so fitted with steady-pins entering holes in a plate permanently attached to the arm of the small metal, that, by the replacing of a single screw, any one of them can be instantly placed in perfect adjustment in the tube. This arrangement, permitting the examination or change of the prisms almost in a moment, with scarcely an interruption of observations, is highly convenient and even essential. After a trial of various modes of imparting just that increase of temperature to the prism, which shall prevent the deposition of dew, and yet produce no apparent disturbance of the rays of the image by radiation, from inequality of temperature, I finally adopted the following:—

"I made for the prism a triangular tin box, lined internally with wash-leather, only just large enough to contain it. When about to prepare for observation, I put this box in my pocket, close to my person; and by the time I have opened the dome, and pointed the telescope, I take out the prism and place it in the box, with the steady-pins before-mentioned; I then find that, even on a very dewy night, the prism will remain perfectly pure for upwards of two hours. Having a spare prism at the same temperature ready to substitute at the end of that period, only a very few moments are lost by the change. The larger boxes, which contain the prisms when in adjustment, are lined with thick *felt*, to prevent radiation; and I generally keep them at a temperature a little above that of the atmosphere, when about to be put into the tube, though not sufficiently so to feel warm to the hand. I would caution any one, using a prism, against leaving it in the tube permanently. To secure, I presume, the requisite high refractive power of the flint glass used for this purpose, so much lead enters into its composition, that it is by no means invulnerable by constant exposure to the deposition of dew, changes of temperature, and atmospheric action. Moreover, the glass is really much softer than crown-glass, and requires wiping always with caution, and the softest and purest material. A very soft and pure silk handkerchief, deposited in a tin box and kept for the purpose, I always employ. The prisms supplied by the Optical Institute at Munich require this care, and *deserve* it.

Deep-red Stars. "September 5. About $10^h\ 40^m$, while sweeping about *Cygnus* and admiring, with power 160, the wonderful

richness and splendour of the milky way, I discovered what appeared to me the deepest red star I have ever seen, magnitude $9\frac{1}{2}$, R.A. $21^h\ 16^m{\cdot}6$, N.P.D. $48^\circ\ 13'$. Many other stars are in the field with it.

"In R.A. $21^h\ 37^m$ N.P.D. $52^\circ\ 42'$ is another deep-red star rather brighter, 8th magnitude.

Curious triple-double Star. "In R.A. $21^h\ 28^m{\cdot}4$, N.P.D. $58^\circ\ 36'$ is a singular group of three stars, each attended by a small companion. The three principal stars form a right-angled triangle, with one side about one-fifth shorter than the other. Calling the star at the most acute angle *a*, and the others *b* and *c*, *a* is rather brighter than the 10th magnitude, *b* and *c* the 11th magnitude, a^2 the 11th, b^2 and c^2 the 12th magnitude. These magnitudes have been determined on the principle of the 'Photometrical Method of measuring the Magnitudes of Stars,' described by the Rev. W. R. Dawes in the eleventh volume of the *Monthly Notices* of the Royal Astronomical Society—a very able paper, which so far as I know has not yet received the attention it deserves. I have not myself, for want of opportunity, verified it by as many observations as I could wish, but I have come to the same conclusion very nearly, with regard to the aperture of a Newtonian telescope required to show a standard 6th-magnitude star; and *that* once determined, Mr. Dawes's method of ascertaining other magnitudes from that standard is extremely rational and simple. But in desiring to ascertain quickly, and with at least sufficient accuracy, the magnitude of a new star found in sweeping, to which some interest may be attached, a good deal of time is lost in trying on different diaphragms in order to ascertain that aperture which will just steadily make the star visible (to say nothing of the great number and variety of diaphragms required in doing this). I have therefore applied an apparatus to the end of the tube of the finder of my large equatoreal, which I find extremely convenient, and which, for magnitudes less than the finder will suffice to show, may be applied to the larger, or indeed any other telescope. My finder is a Newtonian reflector of 4·30 inches aperture and 42 inches focal length, with a magnifying power of 32 times. The end of the tube will just include a square of 3 inches in the side, inscribed within it. I have, therefore, a cap fitting on the end of the tube, out of which such an aperture is accurately cut. At right angles to a diagonal of this square, and at a distance from each other equal to the length of the diagonal, are two cheeks of a dovetail, between which a rectangular plate of metal slides, so that any part of the square can be shut off, and by a graduation on two sides of the square, the exact area exposed can almost without calculation be immediately ascertained.*

* Mr. Lassell's MSS. contained a diagram of his apparatus, which the Editor has not thought necessary for the elucidation of his description. A paragraph or two has here been omitted. See page 83.

"Where the determination of the magnitudes of rather small stars is a point of importance, such an apparatus as this might be applied to the object-glass of a refractor, the sliding plate being moved by a light rack and pinion attached to a Hooke's joint and long handle; thus obviating the extreme trouble and difficulty of getting up to the object-glass of a large telescope to change diaphragms. Magnitudes being often supplemental to the primary observation, any saving of time during a clear sky is of the highest importance; and in this method suggested, nothing more is necessary than to read the division on the graduated side of the square at the time, the resulting magnitude being ascertained afterwards at leisure. If to Mr. Dawes's column of lineal apertures a column of corresponding areas be added, the readings of this variable diaphragm may be compared with it by simple inspection almost without a calculation.

"*Close Satellites of Saturn.*—As observations of the nearest two satellites of this interesting planet are only within the scope of the highest class of telescopes, it may be of some interest to give an epoch or two of them.

"On the 6th of November, 1856, at about $13^h\ 20^m$ G.M.T. *Mimas* was seen as nearly as I can judge at his greatest elongation west, and on the 26th December about $11^h\ 50^m$, I observed him just past his greatest western elongation. The opportunities of seeing this minute and quick-moving body are extremely rare, for I have never seen it, or heard of its having been seen, when much removed from one or other of its elongations; and the short period of its transit over those parts of its orbit must occur when the atmosphere is in a fine state, and when the planet is favourably situated for observation. During the present very wide opening of the ring, this satellite is peculiarly difficult to see, and the more precise observation of an *opposition* or *conjunction*, I believe to be quite impossible in the present state of the telescope.

"*Enceladus* is easily seen in a good state of atmosphere in all positions, but I have not often caught it when optically at its precise conjunction or opposition. Such an epoch, however, occurred on the 1st December, when at $12^h\ 35^m$ G.M.T., *Enceladus* was apparently due south of the centre of the ball.

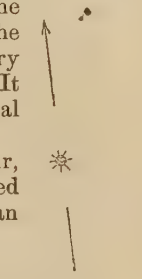
"*Satellites of Jupiter.*—1856, Oct. 5, $10^h\ 45^m$ G. M. T.—The satellites being well situated for comparison, I examined them with power 430. The second is apparently the smallest, the first and fourth seem equal in magnitude; the third is by much the largest. The intrinsic brightness of the first, second, and third, is nearly equal, but the fourth is decidedly less illuminated—indeed it has quite a dull appearance. All have good disks, but the air is moulding and will scarcely allow me to ascertain whether they are perfectly round. The third and fourth seem oval. The planet is very beautiful, but I despair to make a sketch of it. The cloud-like appearance of the principal northern belt is remarkable. A thin strip, north of this ample zone, is very dusky—about the same colour as the principal southern belt: but the very dark cap

which enveloped the northern pole two years ago has quite disappeared. There are certainly chronic changes of great magnitude occasionally occurring on the face of this planet.

"μ^2 *Herculis.*—About two months ago Mr. Dawes drew my attention to this star, merely by the request that I would examine it and tell him 'what was the matter with it.'

"On the 11th November I pointed the telescope upon it with powers 260, 316, and 430. The faint, dull, and generally ill-defined appearance of the star presented a remarkable contrast to the brightness of its neighbour μ itself. On further scrutiny I perceived that μ^2 is double—unequally so, the small companion pointing a little to the north of the line joining μ^2 and μ. The wind was very keen from the north, and vision very bad.

"November 29th, $5^h\ 0^m$ G. M. T.—I surveyed the star again under much better circumstances, though it has now got so far into the twilight that it cannot well be seen until it is three hours past the meridian—a condition which the 20-foot telescope never fails to take cognizance of. I saw the duplicity of the star, however, much better than on the former occasion. The contrast of brightness between the minute-double and the principal star is so striking that the possibly planetary nature of the minute-double is forcibly suggested. It might be an earth and moon, dependent upon the principal star as its primary.



"The small double is a livid or faint purple colour, while the single star is brilliant yellow. I obtained measures of μ^2 from μ in position and distance: the mean gave—

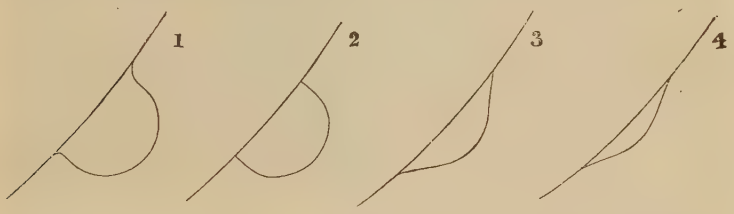
Position, 244° 48′. Distance, 30″·62.

The small double, in Sir William Herschel's nomenclature, I should call very unequal—separated, with 316, nearly a diameter of the small star,—estimated position of the small one from the larger, 55°.

"*Trapezium in the Nebula of Orion.*—December 18.—Vision being very indifferent with the large telescope, I went into the smaller dome and turned the 9-feet equatoreal of nine inches aperture on this object, power 144, with which both the fifth and sixth stars are well seen (or rather *evidently* seen), for the air is much disturbed, though clear. The sixth star appears decidedly the brightest, or the largest, intrinsically, and if in the place of the fifth, would, I think, be more easily seen. Indeed it appears quite as plainly at present. Applied 200—the sixth is now certainly the plainest, and appears to me to be the largest star. But, generally, they are not so easily and instantly seen to-night with 200 as with the lower power. If these stars are unaltered in magnitude, I cannot understand why I should, many years ago, have so often scrutinized the fifth star with this telescope before I detected the sixth.

"*Occultation of Jupiter.*—1857, Jan. 2.—Air exceedingly

troubled. Wind high from S.W., wild sky, with clouds most undefined at their edges, and an under-stratum of scud. Immersion of the fourth satellite not observed. The third occupied about $2^{s}\cdot0$ from first contact until it was obscured. *Jupiter* himself was $1^{m}\ 48^{s}\cdot4$ in being occulted. The air was so extremely unsteady that neither *Jupiter* nor the Moon had a well-defined limb. Having directed my attention as carefully as possible to note the phenomena, I am certain that at least an ocular distortion of the planet took place.



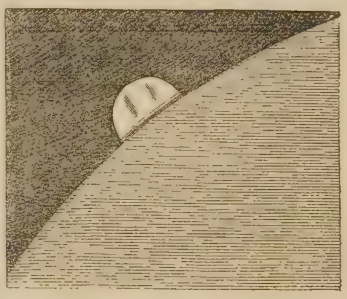
" The annexed diagrams convey nearly my impressions of the alterations of form which took place at different periods of the immersion. When three-fourths occulted, the outline of the remaining portion of the planet was obviously that of a hyperbola, and could not be reconciled with the notion of a circular arc. The first and second satellites occupied less time in immersion than the third—as nearly as I could estimate, $1^{s}\cdot5$ and $1^{s}\cdot7$ respectively.

" Shortly after the immersion of *Jupiter* a violent gust of wind occurred, with a very slight shower, after which the sky became more favourable. I, however, missed the emersion of the fourth satellite, and the third was nearly its own diameter clear of the bright edge of the moon when I first saw it. The contrast of its brightness over that of the fourth, when in the neighbourhood of the moon, was most striking.

" The emersion of *Jupiter* was well observed, my eye catching the very first protrusion of its limb. The planet came out without any distortion that I could remark (except that I retain the faintest notion that when the disk was not more than a fifth part emerged, the arc of its circumference seemed to belong to a larger circle than that of the planet). The atmosphere had now become much more steady. The contrast of brightness of *Jupiter* and the moon scarcely seemed to me to be so great as it might be expected to be from the greater distance of *Jupiter* both from the sun and from us. The planet was certainly much paler than the moon, inclining by contrast to a greenish hue; but I doubt if it would appear so much fainter if placed in comparison with a piece of the moon of only the same size. The flood of light emanating from the moon impairs the sensibility of the eye, so that when the eye is directed to the planet, it looks pale; and as a proof, I found that when the moon's edge was kept only just within the field, the contrast

appeared to be less. The time occupied by the emersion of *Jupiter* was one beat of the watch less than was occupied by the immersion, viz. $1^m\ 4^s{\cdot}0$.

" But the most remarkable phenomenon of the occultation was that during the emersion, a shadowy line appeared projected on the planet from the edge of the moon, in character, magnitude, and intensity extremely like *Saturn's* obscure ring projected on the ball. The power with which this observation was made, 316, being much less than that with which I usually observe *Saturn*, I suppose that this penumbra was really broader, as it appeared to me to subtend about the same angle. With the exception that on the globe of *Saturn*, the projection of the obscure ring forms a line which is concave towards the opposite limb, whereas this projection from the moon's limb was convex towards *Jupiter's* preceding limb, I should pronounce the two phenomena to be identical in appearance; and whoever has seen the one will form a correct notion of the aspect of the other. I never saw this phenomenon before,—but I never before saw an occultation of *Jupiter* under circumstances so favourable and with so powerful a telescope. I think the planet had advanced one-third of its breadth from behind the moon before I noticed this line, — my attention was immediately and strongly drawn to it, and I watched it until close to the complete emersion of the planet without there being any variation of its appearance beyond a tremor or two from the atmosphere. The phenomenon was unmistakable, and I am satisfied there was no illusion.



" *Satellite of Neptune.*—During the most favourable position of *Neptune* the last autumn, the atmosphere was so generally cloudy here, or otherwise unfavourable, that I have scarcely any observations worth recording; however I send the few I was able to obtain.

		G.M.T.	Position.	Distance.	
		h m	° ′		
1856.	Sept. 4	12 19·5	210 46		(*a*)
		12 50·2	....	15·30	
	5	12 29·0	215 24	....	(*b*)
	Oct. 13	11 15·3	37 57	....	(*c*)
		11 2·3	....	17·93	
	19	10 39·5	40 28	....	(*d*)
		10 29·0	....	16·24	
	27	9 14·0	208 5	....	(*e*)

REMARKS.

"(*a*) Wind strong from east, sky whitish and stars unsteady, yet the planet is brighter and better defined than I should expect under the circumstances. Measures of position good — those of distance pretty coincident, yet taken with difficulty. Power used, 614; which is the ordinary observing power for this object. Six measures of position taken — extreme difference, 3° 4′. Five measures of distance taken — extreme difference, 1″·45.

"(*b*) The satellite seems about as far off as last night, or rather closer, but it is too faint to measure in distance satisfactorily.

"(*c*) Only three measures of position taken; extreme difference, 1° 34′, and three of distance; extreme difference, 0″·61. Observation considered good.

"(*d*) Satellite seen with great difficulty. Two measures only of position taken, differing 2° 7′; and three of distance; extreme difference, 1″·32.

"(*e*) Only a single measure of position could be got, and that with the greatest difficulty; much haze existing, and the atmosphere very confused. The satellite could barely be seen at intervals, and measures of distance were impossible.

"*Bradstones, Liverpool, 8th Jan.* 1857."

The Occultation of Jupiter on the 2d of January, as observed at Greenwich.

(*Condensed from the Report sent by the Astronomer Royal.*)

Mr. Main observed with the east equatoreal; Mr. Dunkin, with the north equatoreal; Mr. Ellis, with the 46-inch telescope, power 170; Mr. Criswick, with the telescope formerly belonging to the west equatoreal; and Mr. Lynn, with the altazimuth.

Mr. Glaisher's time observations have been omitted, the telescope used being but small. He remarks, "Nothing particular was observed."

Greenwich M. Solar Times by	M.	D.	E.	C.	L.
	h. m. s	s	s	s	s
Disapp., 4th Sat. first contact	4 44 4·5	...	...	...	...
Disappearance	4 44 5·5	5·7	5·7	14·2	4·2
3d Sat. first contact	4 51 41·1	...	...	...	...
Disappearance	4 51 43·1	42·9	42·9	44·0	43·1
Jupiter's first contact	4 58 33·5	33·8	33·8	32·8	35·0
Last contact	5 0 9·8	9·1	9·3	8·6	7·0
1st Sat. disappearance	5 1 0·6	1·4	1·4	0·4	1·0
2d Sat. first contact	5 2 13·4	...	...	...	...
Disappearance	5 2 14·2	14·2	13·7	13·2	13·1
Reapp., 4th Sat. reappearance	...	...	...	...	...
3d Sat. reappearance	5 49 66·1	46·4	...	...	...
Jupiter's first appear.	5 59 17·1	22·8	17·4	18·9	19·0
Last contact	6 0 52·8	51·6	47·1	48·6	46·8
1st Sat. reappearance	6 1 57·6	64·4	...	...	...
2d Sat. reappearance	6 3 44·3	48·1	42·1	...	47·3

Mr. Main adds, that at the disappearance, while the line of contact advanced steadily, it appeared to him to be bent at its extremities more suddenly than corresponded to the curvature of the moon's limb. "Till considerably past the centre, the line of contact ran steadily on, preceded distinctly by a band three or four seconds in breadth considerably brighter than the general surface of the planet. It was in fact so bright as to efface for that space the appearance of the cloud-belts, which I could not trace up to the line of contact." Mr. Main witnessed a reappearance for an instant after its first obliteration of the thin line to which *Jupiter* was finally reduced, and which he felt certain was not a portion of the moon's limb.

Mr. Dunkin remarks, "No distortion of the planet was seen. . . . . When *Jupiter* was about one-half occulted, the moon's limb, which covered the planet, and which up to this time remained perfectly black, became slightly illuminated, remaining so till the final disappearance of *Jupiter*, when it also instantly disappeared. . . . . The times recorded at the reappearance of all the satellites are probably too late by a few seconds; they were seen instantaneously, but there was evidently in each case a space between the satellite and the bright limb. The time of first reappearance of *Jupiter* was also probably late by two or three seconds, but the time of last contact was accurately observed."

Mr. Ellis remarks, "The reappearances of the fourth and third satellites were not looked for, in consequence of the intervening observations of the moon and stars on the meridian. The reappearances observed were all considered rather uncertain as compared with the disappearances. The reappearance of the first satellite was noticed, but the time observed was so uncertain that it was not recorded."

Mr. Criswick remarks, "The time noted for the occultation of the fourth satellite is doubtful, owing to its faintness. The time for the third is very exact. All the satellites appeared to vanish suddenly, with the exception of the third, which seemed to be about half a second disappearing. None of the satellites could be observed on their reappearing, by reason of the brightness of the moon. At the reappearance of the west limb of *Jupiter* it seemed for an instant, before projecting beyond, to shine through the limb of the moon: beyond this I observed nothing unusual during the occultation."

Mr. Lynn remarks, "The disappearances of the satellites were noticed to be gradual, particularly those of the fourth and third; the times noted are those of final disappearance. In the disappearance of *Jupiter* no distortion of the planet was noticed, nor anything peculiar in the line of contact, which was sharp and well defined. The time of first contact was thought to be a little late."

The observations and notes of the above-named gentlemen will, doubtless, be given with all desirable fulness in the Greenwich volume.

Occultation of Jupiter, as observed at Liverpool.
By John Hartnup, Esq.

The $8\frac{1}{2}$-inch refractor used. Power 134. Sky changeable. "The dark limb of the moon was well seen. The satellites did not disappear suddenly like the fixed stars. In about three or four seconds after first contact they appeared to have lost fully half their brilliancy; they then faded very rapidly, and disappeared altogether in about three or four tenths of a second. Each of the four satellites presented to my eye this appearance. The disk of *Jupiter* suffered no distortion that I could detect, but at the immersion the planet appeared in contact with the moon for three or four seconds before I saw an impression on the disk of *Jupiter*. The moon during this time did not appear to advance on the planet. I did not observe any projection. As the immersion progressed, the jagged edge of the moon on the face of *Jupiter* was very obvious; and immediately before the final disappearance, the thin thread of light remaining of *Jupiter's* disk was for an instant broken up into three or four *beads*.

"At the emersion, the third satellite first appeared in the middle of a large indentation on the margin of the moon's bright limb. My attention had been previously directed to this crater, which was just then on the edge of the bright limb, and my eye was fixed on it when the satellite emerged. In this large cavity the satellite appeared for several seconds to be quite within the margin of the moon's disk; and if it had been the dark instead of the bright limb, the satellite would probably have appeared projected on the disk of the moon. The contrast between the brightness of the satellites and the moon's limb when they first appeared did not strike me as being great; but when a small portion of the disk of *Jupiter* emerged, the dim copper colour of the planet contrasted strongly with the bright limb of the moon. This contrast diminished gradually as more of the planet came out; and when separated from the moon, it was no longer very remarkable."

The following are the Greenwich mean times of immersion and emersion:—

	Immersion. h m s	Emersion. h m s
4th Sat.	4 47 27·84	.....
3d Sat.	4 54 16·81	5 43 39·55
Jup. 1 L.	5 0 31·97	5 53 18·95
Jup. 2 L.	5 2 20·08	5 55 5·66
1st Sat.	5 2 56·18	5 56 22·45
2d Sat.	5 4 4·99	5 58 6·46

Occultation of Jupiter, January 2, 1857, *observed at the Armagh Observatory.* By Mr. N. M'Neil Edmondson.

(*Communicated by Dr. Robinson.*)

	h	m	s
Immersion of 4th Satellite	4	23	56·62
,, 3d ,, ...	4	29	42·18
Contact of Jupiter noticed at	4	35	0·81
Immersion of Jupiter	4	37	6·46
Immersion of 2d Satellite	4	38	23·25

The telescope was a 15-inch Cassegrain, with a power of 260. No change was noticed in the planet. Mr. Edmondson estimated the time of the 4th satellite's entrance to be $0^s \cdot 5$, and that of the 2d to be $0^s \cdot 75$. The dark limb was barely visible.

The Occultation of Jupiter, as observed at Oxford.
Communicated by the President.

Immersions and Emersions in Oxford Mean Time.

		Mr. Johnson. h m s	Mr. Pogson. s	Mr. Quirling. s
Immersion,	4th Sat.	4 39 10·3	15·3	
——	3d Sat.	4 46 39·0	37·7	37·0
——	Jup. I. L.	4 53 36·9 (?)	19·3	
——	Jup. II. L.	4 54 58·1	59·2	57·8
——	1st Sat.	4 55 47·3	46·2	
——	2d Sat.	4 56 58·1	57·7	57·3
Emersion,	4th Sat.	5		
——	3d Sat.	5 42	24·7	
——	Jup. I. L.	5 52 3·9	2·3 (?)	
——	Jup. II. L.	5 53 45·6 (?)	32·1	35·2
——	1st Sat.	5 54	42·4	
——	2d Sat.	5 56 34·7	33·1	

Mr. Johnson observed with the heliometer of 7·5 inches aperture, and power 150: Mr. Pogson, with the equatoreal of 7·2 inches aperture, and power 93; Mr. Quirling, with an achromatic by Dollond, of 3·5 inches aperture, and power 38. The sky was frequently overspread with light clouds, and the moon surrounded by a corona, but not at any time of sufficient importance to interfere with the observations.

Mr. Johnson considers it probable that an error of ten or twenty seconds may have been made in noting the time of first contact by the chronometer, though the phenomenon was accurately remarked. The colour of *Jupiter* on emersion was sea-green. Mr. Johnson also felt conscious that the emersion of the second limb was noted too late.

Mr. Pogson describes the third satellite as occupying nearly two seconds in fading away. The colour of *Jupiter* was considered dull bluish-white; the belts were always well seen. *Jupiter* was less bright than most part of the moon's surface, but not of so feeble a light as the central part of *Mare Crisium*. The calculated interval of immersion or emersion of the planet at Oxford, was $1^m\ 40^s{\cdot}8$.

The following observations were made by Mr. Wm. Luff, at his house, which is situated 26″ south and $1^s{\cdot}3$ east of the Radcliffe Observatory:—

Mean Times at Mr. Luff's house.

Object.	Immersion. h m s	Emersion. h m s
4th Sat.	4 39 12·6	
3d Sat.	4 46 37·8	
Jup. I. L.	.....	5 52 5·4
Jup. II. L.	4 54 57·0	5 53 36·0
2d Sat.	4 56 58·6	

The telescope employed had an aperture of 2·6 inches, and power of about 50. The belts were distinctly seen when only one-third of *Jupiter's* diameter had emerged from behind the moon. Mr. Luff also remarked at the same time the comparative dullness of the planet's light in contrast with that of our own satellite.

Occultation of Jupiter, observed at Ventnor.
By Dr. R. J. Mann.

Telescope by Ross, $3\frac{1}{2}$ inches aperture: power 120.

"The condition of the atmosphere was eminently favourable for the observation, the performance of the telescope being excellent, and the definition very sharp throughout, so much so that about an hour after the termination of the occultation the dusky ring of *Saturn* was visible with the same instrument, under a magnifying power of 195, although the planet was still at a low altitude.

"At $4^h\ 51^m\ 29^s$ contact had certainly occurred between *Jupiter's* disk and the moon. The planet then seemed a trifle flat at one part of its margin, as if suddenly compressed there; immediately afterwards a *sharp* black line was perceptible, advancing over the planetary disk, and cutting the belts. The lunar surface was quite invisible, and the effect was just that of a flat black ebony ruler, with an even edge, being pushed gradually forward in front of the planet. The uncovered portion of the planetary disk during the progress of the occultation retained precisely its *usual* appearance, *the belts remaining ordinarily distinct quite up to the moon's edge*. The outline of the moon's limb was affected by a slightly tremulous movement, but no irregularity was otherwise observable in it, until immediately before the completion of the occultation; then for a passing instant two or three isolated light points hung in the field of vision; in another instant, but one remained; in yet

another instant that was gone. The final disappearance was so distinctly marked, that it could have been fixed easily to the tenth of a second.

"At about $4^h\ 52^m$ the illuminated border of the moon was observed in a state of most exquisitely clear definition. The fourth and third satellites of *Jupiter* were then advanced well away from the moon, but served admirably to indicate the precise point at which the planet was to be looked for. At $5^h\ 52^m\ 22^s$ a minute blotch of very peculiar and unlunar-looking light appeared as if *in front of* the moon's edge, seemingly projected upon the lunar surface. In another second a well-defined segment of the planet's disk was visible, clearly protruding beyond the sharply-cut lunar edge. From this time the difference of the planetary and lunar lights became very remarkable, the hue of the planet being an exceedingly *soft* greenish grey. When the disk of the planet was half exposed the belts presented themselves with far finer definition than they have ever been seen with before in the same telescope, *particularly towards the limb of the planet most remote from the* moon. For more than a minute they were traceable quite up to the edge of the planet's face with a lucidity strikingly unusual. They were also plainly *discernible up to the moon's edge*, but not so obviously as they had been when the dark limb of the moon was lying over the planet previously to the occultation. The surfaces of the moon and the planet were severed by a *half-transparent dusky line*, which had the appearance of being stippled off into the softer hue of the planet's disk. As nothing of this kind presented itself while the moon was passing in front of the planet, it is probable the effect was simply optical, and in some way due to the influence of the superior brilliancy of the lunar light. The effect was, however, very obvious and unmistakable."

Occultation of Jupiter, observed at Haddenham, Bucks, on 2d January, 1857. By the Rev. W. R. Dawes.

"The observations were made with the 8-inch object-glass, by Alvan Clark, mounted equatoreally, and driven by clockwork.

"The state of the air was not very favourable at first; a thin hazy cloud producing diffusion of the moon's light, and rendering the obscure part of the moon quite invisible. A parallel wire micrometer was applied. I intended to observe with power 235; but shortly before the dark edge of the moon reached the fourth satellite, which was near its greatest elongation westward, the thin cloud rendered a lower power preferable, and I exchanged it for 160. Before I could get my eye settled again at the eye-piece, the fourth satellite disappeared.

"The *Third Satellite* disappeared at about $4^h\ 52^m$ G.M.T. The moon's dark edge, which was quite visible upon it, occupied about three seconds in passing over its disk.

"*Jupiter's* total disappearance occurred at about $5^h\ 0^m\ 15^s$ G.M.T. Definition pretty good at the time: the outline of the planet, and the belts, were sharply defined, as was also the dark edge of the moon upon the planet's disk. A large mountainous projection was seen on the part of the moon's limb, nearest the north belt. Not the slightest distortion was seen of the general form of the planet; nor were the belts in the least degree obscured by the proximity of the moon's edge. I, however, noticed a very slight *extension of the light along the dark edge*, to a distance of a second or two on each side of the planet's disk, which continued to be visible throughout the occultation. I have often noticed a similar appearance on the edges of a thick wire, when placed across the disk of a bright planet.

"*First Satellite.*—The edge of the moon occupied *a trifle more than two seconds* in passing over this satellite, and was distinctly visible upon its disk. Time not noted.

"*Second Satellite.*—The moon took *not quite two seconds* in occulting this satellite: between four and five beats of the chronometer were counted, which = about $1^s{\cdot}8$. Edge distinctly seen upon it. Time of disappearance not noted.

"*Reappearance of Fourth Satellite*, at the moon's bright edge. Having previously placed a wire of the micrometer, so as to indicate the point of the limb where the satellite would reappear, my eye caught it the instant it projected from the edge, which was at that place very free from inequalities. I counted about four beats of the chronometer (= $1^s{\cdot}6$) before it was quite free from the moon's edge. There was no projection on the edge, nor any unwillingness to separate. The colour of this satellite did not differ much from that of the moon, perhaps a trifle redder; but it was decidedly *fainter*. It came out as a perfectly round little disk, quite free from distortion. Time about $5^h\ 36^m\ 50^s$ G.M.T.

"*Reappearance of Third Satellite*, at about $5^h\ 48^m\ 8^s$ G.M.T. Time occupied in coming out about six or seven beats of the chronometer (= $2^s{\cdot}6 \pm$), from first catching sight of it; my eye being well directed to the place by the micrometer wire. Colour of the satellite a *pale green*. It lost its light from contact with the moon's bright edge to a far greater extent than the fourth satellite did, in proportion to their usual brilliancy. Quite round, and free from any adhesion.

"*Jupiter* was of a *pale green* at its reappearance. Its *figure was perfect;* no distortion, nor diffusion of light where the edge of the moon cut the edges of the planet. A pale *bluish-purple* line, darkest close to the moon's edge, and gradually fading away, was visible on the disk of *Jupiter*. Its breadth was about $5''$, as nearly as I could judge. This was evidently *the bluish fringe of the secondary spectrum*,—the object-glass being a little overcorrected. Both the planet and the moon were sharply defined and pretty quiet. Total reappearance at about $5^h\ 59^m\ 15^s$ G.M.T.

"*Reappearance of the First Satellite*, at about $6^h\ 1^m\ 30^s$ G.M.T. Occupied about four or five beats of the chronometer in coming

out ($= 1^s{\cdot}8 \pm$) from the first glimpse I observed of it. Not so pale as the third satellite, though obviously smaller, and seemed to suffer less in brightness from proximity to the moon. Quite round.

"*Reappearance of the Second Satellite*, occupied about four beats of the chronometer ($= 1^s{\cdot}6$) after being first seen. The place was well indicated, as before, by the micrometer wire. The colour of this satellite was like that of the first, but its disk was obviously smaller. It was quite round, and parted from the moon without hesitation.

"The approximate geographical position of my observatory is in lat. 51° 45′ 50″ north, and long. $3^m\ 44^s{\cdot}0$ west."

Note on the Occultation of Jupiter of January 2, 1857.
By W. R. Grove, Esq., V.P.R.S.

"Owing to the great kindness of Mr. Gillett, I was enabled to observe this occultation through his binocular telescope. This instrument is by Ross, the object-glasses $3\frac{3}{8}$ inches diameter, focal length 51 inches: portions (about $\frac{3}{4}$ inch) of the glasses are ground away to enable them to be approximated sufficiently for the distance between the eyes of the observer. The power used was 60, which gave a greater idea of magnitude than double that power in a monocular telescope.

"The dark limb of the moon was faintly visible throughout the time of the occultation. The disappearance of the satellites was not instantaneous as with a fixed star, but (as indeed might have been expected) they gradually faded away. The light of the moon's edge was too feeble for me to ascertain whether they disappeared at the exact edge or not. I should say that they seemed to be a little within it, but I could not positively assert this. *Jupiter* was cut off with perfect sharpness, and I could not detect the slightest distortion. When about one-third was eclipsed the light of the planet appeared brighter along the edge of the moon, and this apparently increased brightness continued until it was about three-fourths eclipsed. Two spots in the neighbourhood of the upper belt (as viewed by inverting telescope) were notably bright, so as to attract attention, and they continued so during the period above mentioned, each looking somewhat like an electric glow coming off the dark edge of the moon. This effect may be optical, and caused by the immediate proximity of darkness to central and more luminous portions of the planet, but it was very marked. I observed no other effect during the period of immersion. I looked for an effect said to have been observed on previous occasions, viz. a faint illumination of the dark edge of the moon upon contact, but could not detect the slightest trace of it. On emersion I could detect no distortion of any sort, nor did I see the dark line which I noticed in the occultation of Nov. 8, 1856. The difference of light and colour between the planet and the moon was the same as then observed.

"After emersion there was a decided stereoscopic effect, seen both by Mr. Gillett (who, up to this time had left the telescope entirely to me,) and myself, *Jupiter* in the binocular appearing as at a distance behind the moon. Mr. Gillett tells me that with terrestrial objects the effect of the binocular, if inverting eye-glasses are used, is in many instances pseudoscopic, the more distant objects appearing nearer than the more proximate, which is the effect that theory would indicate.

"The satellite, last in order on emersion, seemed to cling for a second or so to the moon's edge, probably an effect due to irradiation. I did not observe this with the three others, but I did not catch the moments of emersion so well with them. I was greatly struck by the beautiful impression conveyed to the mind by the binocular telescope, and judging from what I had seen with a monocular telescope of my own, of 4·3 inches aperture, and therefore not far differing in area from the compound area of the two object-glasses in the binocular, the latter was decidedly superior, and the ease and, if I may be allowed the expression, the *naturalness* of the vision, was very remarkable."

Note on the Occultation of Jupiter on the 2d January, 1857. By Mr. John Watson, Washington Chemical Works, Durham.

"The evening of the 2d instant being remarkably clear, I resolved to watch the appearance of *Jupiter* in a *star-gazing fashion* only during the occultation, leaving the time-observations to other and better-equipped observatories. To secure the utmost degree of stability, I placed the telescope, a 9-ft. Newtonian of 8-inches aperture, power 100, with its lower end on the ground, supporting the upper end of the tube with a Smeaton's stand.

"The satellites disappeared at the slightly illuminated edge of the moon, without anything unusual being noticed. From the moment of first contact *Jupiter* disappeared smoothly and gradually, and without the least perceptible distortion. The couple of minutes which elapsed between first contact and total disappearance afforded abundance of time to notice the well-defined, curved outline of the moon as projected on the disk of *Jupiter*, and also to observe that the belts of the planet could easily be traced *unaltered* up to the moon's dark limb.

"The two preceding satellites served admirably as *pointers* to indicate the place of emersion at the bright side of the moon. As *Jupiter* emerged from behind the moon, the belts were again noticed *unaltered;* nor was the least distortion observed on the edges of either the moon or planet. No dark line of separation could be seen; but the greenish tint, noticed by Mr. De la Rue in November, was very perceptible on the face of *Jupiter*.

"I should not have considered it necessary to lay before the Society a paper containing so many negative results had not some other published observations been so widely different."

Mr. Slatter, of Rose Hill, Oxford, writes:—"The time and sky on the 2d were so favourable that I dare say you will be inundated with notices. I venture to add mine." The planet emerged "with no distortion of image. The moon's limb was very wavering; the planet's perfectly defined and steady: its colour had a slight inclination to green; I conclude by contrast."

"The first satellite emerged also in all respects as it had entered; but the second satellite remained hanging to the moon's limb for four seconds: during the first second, I thought it must be an inequality on the moon's limb; but its greater paleness showed it to be the satellite: when it let go the moon's limb, it started away spasmodically a considerable space.

"I have hitherto been rather sceptical about such appearances, attributing them to the want of power in the instrument, or the fatigued vision of the observer; but what I saw I feel sure was the effect of our own atmosphere, and no lunar appendage.

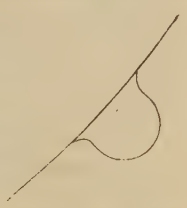
"It is worthy of remark that the flickerings were entirely interrupted at that part of the Moon's limb, at which the planet was emerging. I remember noticing the same thing very particularly in the case of the sun's limb on the occasion of the transit of *Mercury* in 1848.

"I make the following extract from my book, Nov. 9, of that year: 'Very difficult to say when *Mercury* was fully in, as the sun's limb was very wavy: certainly no black thread formed. The power used was 117, the lowest of the micrometer being too high for the day. Air loaded with vapour. It is to be noted that the first appulse was easily visible, because it *stopped* the apparent waves on the sun's limb.'"

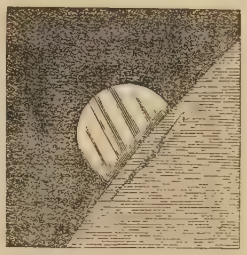
Occultation of Jupiter. By W. Simms, Esq.

"The occultation of the planet *Jupiter* by the moon on the 2d inst. was seen by me at Carshalton: the immersion with an achromatic object-glass of 15 inches, and the emersion with one of 13 inches aperture, and a power of 200 in both cases.

"The moon's limb advanced steadily over the planet till the latter was about half occulted, when I observed that at the extremities of the line of contact the planet appeared as represented in the accompanying figure, and this appearance continued till only a very small part of the planet remained visible. It is true that there was, at the time, much unsteadiness of atmosphere, but I watched the phenomenon very attentively, and believe I was not mistaken.



"The only remarkable appearance noticed by me during the emersion was the very positive line by which the moon's limb was marked upon the planet; dark as the mark of a black-lead pencil close to the limb, and gradually softened off as the distance increased.



"The occultation was observed in London by Messrs. James Simms and W. Simms, jun., by the former with a telescope of $2\frac{1}{4}$ inches, and by the latter with one of $5\frac{1}{2}$ inches aperture. The appearance noticed by me during the immersion was not seen by either of them, but the line defining the moon's limb upon the body of the planet was distinctly seen by both."

In addition to the foregoing accounts, which are for the most part given nearly as received from their respective authors, are many others from which extracts only can be taken.

Dr. Lee observed with his assistant, Mr. Horton, and forwarded letters and sketches from Dr. Brereton of Bedford, and Dr. Turnbull of Aylesbury.

Mr. T. Dell, of Aylesbury, observing with a power of 100, noticed no distortion till five or six seconds before immersion, when the limb became much elongated. The same thing was observed for about the same space of time at the emersion of the first limb.

The Rev. C. Lowndes, of Hartwell, observing with a power of 240, remarked that the limb of *Jupiter* became elongated a few seconds before immersion, and that the light appeared to increase and redden at the side nearest the moon.

Mr. John Peto, writing from Brighton, where he observed with a 5-feet refractor by Tulley, and power 120, says, "The planet emerged steadily till it had nearly left the moon, when for a few seconds it appeared projected on the moon's disk; a dark line, as if of shadow, defining the edge. The pale greenish light of *Jupiter* contrasted strongly with the golden colour of the moon."

Mr. R. Hodgson observed with an 8-feet equatoreal of 6 inches aperture, and power 160. "Not the slightest change of form or colour was noticed." At emersion the light of *Jupiter* appeared pale, and slightly tinged with blue as compared with the moon. Mr. Hodgson writes at the same time, that with the same telescope, and power 140, he witnessed a projection of the first satellite on the disk of *Jupiter* on the 3d of January, with a clear space around it for nearly a minute.

The Rev. T. W. Webb observed with a $5\frac{1}{2}$-feet achromatic, and power 144, from Hardwick, near Hay, South Wales. He

writes, "The planet exhibited no distortion, or other unusual appearance, but it left behind it a diffused glimmering of small extent upon the limb, which might probably be due to the want of more perfect definition." Mr. Webb speaks also of the contrast of the paler light of *Jupiter* with that of the moon, and adds, "From which, in all probability, arose the appearance, which seemed to exist, of a narrow darkish border attached to the lunar limb."

Mr. W. Huggins, of Tulse Hill, Norwood, sent his observed times of immersion and emersion. He saw no distortion or projection at either.

Mr. Hippisley, in a letter to Mr. De la Rue, mentions having seen a distortion of form which he describes thus:—"One thing struck me very much, which I did not at all expect, and am pretty sure was not illusive, which was the flattening of *Jupiter's* limb next the moon at the moment at which the line of darkness between the lunar and jovian limbs appeared (*i. e.* at emersion), so that to my eye the equatoreal diameter of the planet did not for a second or two seem more than the polar."

Mr. F. Brodie, of Eastbourne, observed with his $7\frac{1}{2}$-inch glass, and power 106. He writes, "I did not notice any distortion of the disk of the planet either at its disappearance or reappearance. I was, however, very much struck with the disappearance of the fourth and third satellites. The moon's disk gradually advanced over the disk of the satellite, and when the satellite's disk had quite vanished, there remained a small semi-halo of light for the space of one-third to half a second around the point of its disappearance, forcibly reminding me of a *sunset in miniature*." The times of occultation were sent.

Mr. Perigal sent his observations of immersion and emersion taken at Lewisham, where he used a small telescope by Dollond. He saw no distortion or projection.

Mr. T. W. Burr, of Highbury, writes, "At the moment of contact the dark limb of the moon became suddenly illuminated to the extent of about three diameters of the planet both above and below it. The appearance was that of a thin line of silvery light, shading rapidly off to the inside of the circle. It was almost momentary in duration, certainly not exceeding two seconds. I had previously satisfied myself that the whole disk of the moon was not visible by the ashy light usually seen when it is young." Mr. Burr also sent local sidereal times of the occultation.

Mr. J. W. Jeans, of Grantham, made similar observations, but under unfavourable circumstances. He forwarded his observed times, and sent with them an account of the previous occultation on the 8th of Nov. 1856, which laboured, however, under the same disadvantages.

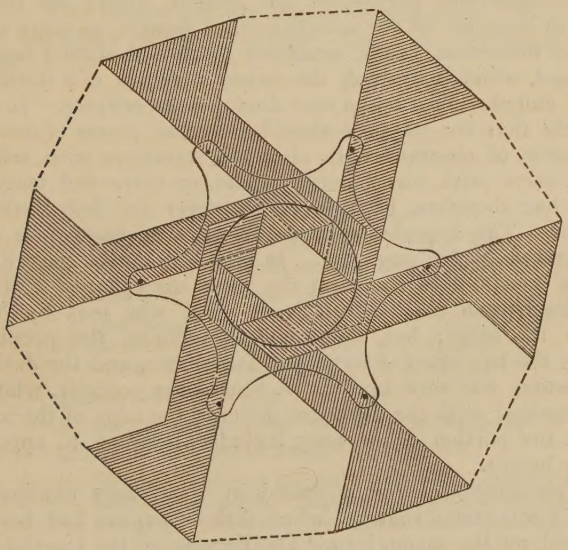
Mr. Matthew Jee, of Edge Hill, Liverpool, sent a short account through Mr. Hartnup.

Lord Wrottesley sent a short account of the observations taken at his observatory at Wrottesley with the 11-feet equatoreal, and power 140. No distortion was noticed. "It should, however, be

observed that for some seconds after the first contact a rosy purplish light appeared on the moon's limb where the planet was disappearing."

Mr. Worthington, of Crumpsall Hall, Manchester, observed with a refractor of 5 inches aperture, power 125, in company with his friend Mr. Baxendell, to whom he gave up his Newtonian of 13 inches aperture, focal length 9 feet, power 108. "Mr. Baxendell observed that the limb of the planet at the point of contact with the dark limb of the moon suddenly presented a reddish appearance. . . . . Neither of us perceived any distortion of the form of the planet." The times observed were sent. The position of Mr. Worthington's observatory was also stated to be—latitude $53^{\circ}\ 30'\ 49''{\cdot}2$, longitude $8^{m}\ 55^{s}$ west.

The Editor of the present *Notice* has been induced, by the perusal of Mr. Lassell's communication, in which is proposed a construction of diaphragm for measuring the area of object-glass exposed during photometric measurements, to send the following one, which has been applied to the equatoreal at Redhill for more than two years past. The inner circle in the figure represents the



full size of the object-glass, on to the end of which is fitted the piece with the re-entering curves, containing the centres of motion of six thin plates of brass, formed somewhat like knife-blades.

The construction is so simple as to require little explanation. The one idea in it is the use of parallel motion, whereby, by the introduction of the connecting pieces, represented by the dotted lines, the six blades are constrained to move simultaneously through equal angles, their inner edges then forming a hexagonal diaphragm variable in dimensions at the pleasure of the observer, who is supposed to be furnished with a light rod led down the tube of the telescope, carrying at its upper end a small pinion, working in a piece of rack-work attached to any one of the blades. An indicating-plate at the lower end serves to show the aperture at any moment. The above plan has been kept back hitherto from an unwillingness to communicate schemes unaccompanied by results of observation; but as copies have been given to various friends, and the present appears a natural occasion to introduce it to these pages, it is herewith given as a note to Mr. Lassell's paper. It is well known that Steinheil attains a similar result by the use of a movable circular stop within the telescope tube. It is not, however, intended to discuss the relative merits of the different constructions.—[R. C. C.]

A considerable portion of the present *Notice* has been devoted to accounts of the occultation of *Jupiter*, as many appearances of distortion, beads, scattered light, and altered tints were witnessed, which bear upon the vexed question of a lunar atmosphere and the phenomena seen during solar eclipses. It seemed desirable that the inquirer should have the power of comparing the results of observer with observer, refractors with reflectors, high powers with low powers. The aperture and magnifying power has, therefore, been given wherever the information was supplied. The hyperbolic forms on page 69 have been a little exaggerated by the engraver. In the woodcut on page 81 there will be seen a dark score on the moon unexplained in the text. The description there given is of what was seen by Mr. W. Simms the elder; but the woodcut includes the peculiarities seen by the two other observers of that name, and the dark mark in question was seen by Mr. W. Simms the younger, who states that, together with the dark line defining the edge of the moon, it caused the portion of the body included between to appear unusually bright.

A paragraph having appeared in *The Times* newspaper, in which it was stated that the whole disk of *Jupiter* had been seen projected on the moon, by a 'Dr. Forster on the Continent,' the Editor wrote to Dr. Förster of the Berlin Observatory, and is authorised to state that no such appearance was seen by *him*, the weather having been such as to prevent the occultation being observed at all at Berlin.

The 4th volume of the *Markree Catalogue* has just appeared, containing the approximate positions of an additional 14951 stars; making a present total of 60066. A supplementary volume will still be required for the publication of a few unfinished zones.

Mr. Hind has just circulated a new *Sweeping-Ephemeris of the Great Comet of* 1556, in which geocentric positions, computed from new elements, are given for every tenth day of the year.

We learn by No. 1064 of the *Astronomische Nachrichten*, that Dr. Argelander has just published the first four charts of his proposed *Atlas of the Northern Heavens for the beginning of the Year* 1855. We may have occasion to refer again to this projected work in a future number.

To be sold, the property of a Fellow of the Society, a small altitude and azimuth instrument, by W. and S. Jones of Holborn, London. The circles are six inches in diameter. May be seen at the chambers of T. W. Burr, Esq., 12 Paternoster Row. Price 9*l.*

ERRATA.

Vol. xii., p. 34, line 8 from the bottom, *for* $2^h\ 1^m$, *read* 2^h P.M.

— xiii., — 218, line 31, *for* 'combination,' *read* 'continuation.'

— xiv., — 158, line 2, *for* 'on,' *read* 'or.'

— xv., — 9, read thus,—
For the horizontal semidiameter = 4″·750484
For the vertical semidiameter = 4 ·750554

— xv., — 14, last line, *for* 'greater,' *read* 'less.'

— xv., — 140, line 3 in the note, *read* 'coincides *best* practically.'

— xv., — 144, line 18, *for* 'official fiction,' *read* 'friction.'

— xvi., — 63, line 11. Substitute the words, 'Very few *accessory dots* were seen' for the words, 'There were very few penumbræ without a nucleus.' The word in the German is *Nebenpunkten*, denoting the little changeable dots so frequently sprinkled around the main spot.

— xvi., — 185, line 12, *for* 'zinc-ball,' *read* 'time-ball.'

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